

REMARKS

The Office Action mailed June 6, 2005, has been received and reviewed. Claims 1 through 51 are currently pending in the application, of which claims 1 through 15 and 38 through 45 are currently under examination. Claims 16 through 37 and 46 through 51 are withdrawn from consideration as being drawn to a non-elected invention, and have been canceled herein.

Claims 1, 2, 9 and 38 have been amended.

Claim 1 has been amended to further patentably distinguish the recited method from the reference as applied by more precisely specifying the nature of the underfilling act as recited.

Claim 2 has been amended into independent form and incorporates the subject matter of claim 1 prior to the current amendments thereto.

Claim 9 has been amended to improve antecedent basis in light of the amendments to claim 1.

Claim 38 has been amended to further patentably distinguish the recited method from the combination of references as applied by more precisely specifying the nature of the recited underfilling act.

35 U.S.C. § 102(b) Anticipation Rejections

Anticipation Rejection Based on U.S. Patent Application Publication No. 2002/0066523 A1 to Sundstrom, et al.

Claim 1, and claims 7 through 10, stand rejected under 35 U.S.C. § 102(b) as being anticipated by Sundstrom, *et al.*, U.S. Patent Application Publication No. 2002/0066523 A1 (hereinafter "Sundstrom"). Applicants respectfully traverse this rejection, as hereinafter set forth.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

As applied to claim 1, Sundstrom teaches a method of forming a bond between a

semiconductor device and a substrate that employs a polymer with low wetting characteristics. In particular, Sundstrom teaches depositing a polymer paste material 14 onto a device bond area 25 and extending onto the polymer mask 24. Pg. 2, ¶¶ 19-22. Conversely, the polymer paste material 14 may be deposited upon a substrate bond area 18 and extending onto the *substrate polymer mask* 16. Pg. 1 – 2, ¶ 15. It must be noted that the polymer mask 16/24 is present in each instance before applying the polymer paste material. The polymer paste material is partially cured to form a polymer bump, after which the device 10 is placed on the substrate 12. Pg. 2, ¶¶ 22-24. The polymer paste material 14 is then fully cured, which causes the surface tension of the polymer paste material to pull the paste into a vertical column and align the device bond area 25 over the substrate bond area 18. Sundstrom also teaches integrating multiple electrical and optical interconnects between a Flip Chip on Board (FCOB) die and a “host” substrate with another FCOB mounted to the backside of the substrate. Pg. 2, ¶ 27.

Sundstrom, however, fails to describe forming at least a first alignment droplet and at least a second alignment droplet from a flowable alignment material at laterally spaced locations on a substrate and positioning first and second semiconductor dice respectively using the surface tension of each alignment droplet. Further, Sundstrom fails to describe introducing an underfill material adjacent the surfaces of the first and second semiconductor dice and surrounding the respective at least a first and second alignment drops to form a reconstructed semiconductor wafer. Thus, Sundstrom fails to anticipate each and every element of claim 1, either expressly or inherently.

The Examiner has apparently misapprehended the polymer mask 16/24 deposited *prior to* the polymer paste 14 of Sundstrom as an underfill. Further, the polymer mask simply masks selected areas of the substrate/die from wetting to the polymer paste. Further, Sundstrom does not reconstruct a semiconductor wafer.

Applicants have amended claim 1 to more positively recite the method of the present invention and clarify patentable distinctions between Applicants’ invention and Sundstrom by reciting “. . . introducing an underfill material between the surfaces of the first and second semiconductor dice and the substrate to substantially fill a volume between each of the first and second semiconductor dice and the substrate, to extend laterally between the first and

second semiconductor dice and to surround the at least a first alignment droplet and the at least a second alignment.” Sundstrom does not introduce any material between surfaces of a die and a substrate to substantially fill a volume therebetween, does not extend a material laterally between first and second dice, and to surround alignment droplets. Again, Applicants note that the mask material of Sundstrom is preplaced prior to application of the polymer paste material.

Because Sundstrom fails to anticipate each every element of claim 1, the withdrawal of the 35 U.S.C. § 102(b) rejection is respectfully requested.

Claims 7-10 are each allowable for, among other reasons, depending directly or indirectly upon allowable independent claim 1, which is allowable.

Claim 9 is additionally allowable because Sundstrom fails to anticipate introducing an underfill material between the first and second semiconductor dice and the substrate in the form of a fixture plate.

Claim 10 is additionally allowable because Sundstrom fails to anticipate curing an underfill material to a substantially solid state.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent Application Publication No. 2002/0066523 A1 to Sundstrom, et al., and further in view of U.S. Patent Application Publication No. 2003/0164555 A1 to Tong, et al.

Claims 5 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sundstrom as applied to claims 1, 7 through 10 above, and further in view of Tong, et al., U.S. Patent Application Publication No. 2003/0164555 A1 (hereinafter “Tong”). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on

applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

As noted above, Sundstrom fails to anticipate claim 1. Tong fails to cure the deficiencies in the teachings of Sundstrom.

The 35 U.S.C. § 103(a) obviousness rejections of claims 5 and 6 are improper because the nonobviousness of independent claim 1 precludes a rejection of claims 5 and 6, which depends therefrom because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, the Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to dependent claims 5 and 6 which depends from allowable independent claim 1.

Claims 5 and 6 are further allowable because there is no motivation or suggestion to combine Tong with Sundstrom. Tong discloses a material used for underfill which may, incidentally perform an alignment function, but not as an alignment droplet; Tong provides no disclosure of its ability to be used as an alignment droplet in conjunction with an alignment cavity in a die surface. Absent an impermissible reference to Applicants' own disclosure, there would be no motivation or suggestion to combine the references as attempted by the Examiner.

In consideration of the foregoing arguments, claims 5 and 6 are allowable and the withdrawal of the 35 U.S.C. § 103(a) rejection is respectfully respected.

Obviousness Rejection Based on U.S. Patent Application Publication No. 2002/0066523 A1 to Sundstrom, et al. and further in view of U.S. Patent No. 6,013,534 to Mountain

Claims 11 through 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sundstrom as applied to claim 1, and claims 7 through 10 above, and further in view of Mountain, U.S. Patent No. 6,013,534 (hereinafter "Mountain"). Applicants respectfully traverse this rejection, as hereinafter set forth.

As set forth above, Sundstrom fails to teach all of the elements of claim 1. Mountain fails to cure the deficiencies in Sundstrom.

Because Sundstrom, in view of Mountain fails to teach or suggest every element of

independent claim 1, claim 1 is therefore non-obvious and allowable.

Furthermore, Sundstrom and Mountain provide no motivation or suggestion to combine or modify the references, nor any reasonable expectation of success. Mountain is directed toward a process of thinning individual semiconductor die carried in an assembly comprising a “template wafer,” not a method of thinning a reconstructed semiconductor wafer as fabricated by Applicants to singulate semiconductor dice. Sundstrom is merely directed toward attachment of a semiconductor die to a host substrate. Thus, absent an impermissible reference to Applicants’ own specification, any motivation to combine such different and distinct structures and processes is speculative, and no reasonable expectation of success is to be found.

The 35 U.S.C. § 103(a) obviousness rejections of claims 11 – 15 are improper because the nonobviousness of independent claim 1 precludes a rejection of claims 11-15, which depends therefrom because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, the Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to dependent claims 11-16 which depends from allowable independent claim 1.

Claim 11 is additionally allowable because neither Sundstrom nor Mountain disclose singulating semiconductor dice from a reconstructed semiconductor wafer as fabricated by Applicants.

Claim 12 is additionally allowable because neither Sundstrom nor Mountain disclose singulating semiconductor dice through the process of backgrinding the reconstructed semiconductor wafer to remove the underfill material. Mountain, as discussed above, uses backgrinding to thin individual die; it does not disclose using backgrinding *in singulating* semiconductor dice from a reconstructed wafer. Rather, Mountain discloses singulating the die *with the transfer wafer attached*, the transfer wafer being removed, if at all, at a later time. Col. 7, lines 26-45; Col. 7, lines 55-59.

Claim 13 is additionally allowable because neither Sundstrom nor Mountain discloses a process of removing a fixture plate adhered to an underfill material by backgrinding the reconstructed semiconductor wafer.

Therefore, claims 11-15 are each allowable and the withdrawal of the 35 U.S.C. § 103(a) rejection is respectfully requested.

Obviousness Rejection Based on U.S. Patent Application Publication No. 2002/0066523 A1 to Sundstrom, *et al.*, in view of U.S. Patent No. 6,013,534 to Mountain

Claims 38 through 40, 42, and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sundstrom in view of Mountain. Applicants respectfully traverse this rejection, as hereinafter set forth.

Independent claim 38 recites a method of performing wafer-level processing on a number of separate semiconductor devices. The method of claim 38 as presently amended comprises, among others, underfilling the between the positioned semiconductor dice and a substrate having alignment droplets positioned thereon to form a reconstructed semiconductor wafer and performing wafer-level processing on the reconstructed semiconductor wafer. Sundstrom, as discussed above, fails to teach underfilling the positioned semiconductor dice to form a reconstructed wafer. Pg. 1 – 2, ¶ 15. The Examiner mischaracterizes the polymer mask 16/24 deposited *prior to* the polymer paste 14 of Sundstrom as underfill, which it is not. The polymer mask is meant simply to mask those areas of the substrate/die from whetting to the polymer paste. Additionally, Sundstrom fails to teach or suggest fabricating a reconstructed semiconductor wafer. At most, as discussed above, Sundstrom teaches fabrication of a FCOB assembly consisting of a substrate with two FCOB devices, not a reconstructed semiconductor wafer. Finally, Sundstrom fails to teach performing wafer level processing on the reconstructed semiconductor wafer. Mountain, like Sundstrom, also fails to disclose underfilling semiconductor dice positioned by their back sides using alignment drops positioned on a substrate to form a reconstructed semiconductor wafer and merely singulates dice in combination with a portion of a “transfer wafer” after thinning of the dice. No wafer level processing is effected by Mountain. Because Sundstrom, in view of Mountain fails to teach or suggest every element of independent claim 38, claim 38 is therefore non-obvious and allowable.

Furthermore, and as noted previously, Sundstrom and Mountain provide no motivation or suggestion to combine or modify the references. Mountain is directed towards a process of

thinning individual semiconductor die, not a method of fabricating a reconstructed semiconductor wafer from individual semiconductor dice and performing wafer level processing thereon. Therefore, independent claim 38 is allowable and the withdrawal of the 35 U.S.C. § 103(a) rejection is respectfully requested.

The 35 U.S.C. § 103(a) obviousness rejections of claims 39, 40, 42, and 43 are improper because the nonobviousness of independent claim 38 precludes a rejection of claims 39, 40, 42, and 43, which depends therefrom because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, the Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to dependent claims 39, 40, 42, and 43 which depends from allowable independent claim 38.

Claim 43 is additionally allowable because both Sundstrom and Mountain fail to disclose introducing an underfill material between rear surfaces of semiconductor dice and a surface of the fixture plate.

Considering the foregoing arguments, claims 38-40, 42, and 43 are each allowable and the withdrawal of the 35 U.S.C. § 103(a) rejection is respectfully requested.

Obviousness Rejection Based on U.S. Patent Application Publication No. 2002/0066523 A1 to Sundstrom, et al., in view of U.S. Patent No. 6,013,534 to Mountain and further in view of U.S. Patent Application Publication No. 2003/0164555 A1 to Tong, et al.

Claim 41 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Sundstrom in view of Mountain as applied to claims 38 through 40, 42, 43 above, and further in view of Tong. Applicants respectfully traverse this rejection, as hereinafter set forth.

As set forth above, Sundstrom and Mountain fail to teach all of the elements of claim 38. Tong fails to cure the deficiencies in the combined teachings of Sundstrom and Mountain.

The 35 U.S.C. § 103(a) obviousness rejections of claim 41 is improper because the nonobviousness of independent claim 38 precludes a rejection of claim 41, which depends therefrom because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP §

2143.03. Therefore, the Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to dependent claim 41 which depends from allowable independent claim 38.

Obviousness Rejection Based on U.S. Patent Application Publication No. 2002/0066523 A1 to Sundstrom, *et al.*, in view of U.S. Patent No. 6,013,534 to Mountain and further in view of U.S. Patent No. 6,064,221 to Moden, *et al.*

Claims 44 and 45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sundstrom in view of Mountain as applied to claims 38 through 40, 42, 43 above, and further in view of Moden, *et al.*, U.S. Patent No. 6,064,221 (hereinafter “Moden”). Applicants respectfully traverse this rejection, as hereinafter set forth.

As set forth above, Sundstrom and Mountain fail to teach all of the elements of claim 38. Moden fails to cure the deficiencies in the combined teachings of Sundstrom and Mountain.

Furthermore, Sundstrom, Mountain, and Moden provide no motivation or suggestion to combine or modify the references. Moden is directed towards a method of testing and burn-in of individual semiconductor die, not the wafer-level testing of reconstructed semiconductor wafers, and is specifically directed to retaining a die in a single-die, temporary test package. Any suggestion that the method of Moden is directed to anything other than die is a misapprehension of the disclosure. Thus, no motive or suggestion exists to combine the references and independent claim 38 is allowable.

The 35 U.S.C. § 103(a) obviousness rejections of claims 44 and 45 are improper because the nonobviousness of independent claim 38 precludes a rejection of claims 44-45, which depends therefrom because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, the Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to dependent claims 44-45 which depends from allowable independent claim 38.

Claim 44 is additionally allowable because Sundstrom, Mountain, and Moden fail, individually and in combination, to teach performing a *wafer-level* testing operation on the

reconstructed wafer.

Claim 45 is additionally allowable because Sundstrom, Mountain, and Moden fail, individually and in combination, to teach performing burn-in at the *wafer level* on the reconstructed wafer.

Objections to Claims 2 through 4/Allowable Subject Matter

Claims 2 through 4 stand objected to as being dependent upon rejected base claims, but are indicated to contain allowable subject matter and would be allowable if placed in appropriate independent form.

The examiner's statement that claims 2-4 contain allowable subject matter, but stand objected to as being dependent upon rejected base claims is appreciably noted. Claim 2 has been placed in independent form, incorporating the limitations of claim 1 prior to the present amendments thereto.

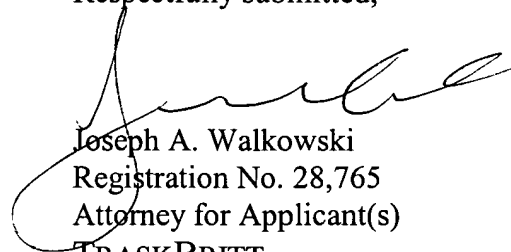
ENTRY OF AMENDMENTS

The amendments to claim 1, 2, 9 and 38 should be entered because they are supported by the disclosure of the as-filed application. No new matter has been added.

CONCLUSION

Claims 1-15 and 38-45 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,



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